36. When Earth and the Moon are separated by a distance of 3.84×10^8 meters, the magnitude of the gravitational force of attraction between them is 2.0×10^{20} newtons. What would be the magnitude of this gravitational force of attraction if Earth and the Moon were separated by a distance of 1.92×10^8 meters?

A) 4.0×10^{20} N B) 2.0×10^{20} N
C) 5.0×10^{19} N D) 8.0×10^{20} N

Base your answers to questions **37** and **38** on the information below.

A go-cart travels around a flat, horizontal, circular track with a radius of 25 meters. The mass of the go-cart with the rider is 200. kilograms. The magnitude of the maximum centripetal force exerted by the track on the go-cart is 1200. newtons.

37. Which change would increase the maximum speed at which the go-cart could travel without sliding off this track?

A) Decrease the coefficient of friction between the go-cart and the track.
B) Increase the mass of the go-cart.
C) Increase the radius of the track.
D) Decrease the radius of the track.

38. What is the maximum speed the 200.-kilogram go-cart can travel without sliding off the track?

A) 150 m/s B) 12 m/s
C) 8.0 m/s D) 170 m/s

39. A 25-newton weight falls freely from rest from the roof of a building. What is the total distance the weight falls in the first 1.0 second?

A) 4.9 m B) 2.5 m
C) 9.8 m D) 19.6 m

40. Which is an SI unit for work done on an object?

A) $\frac{kg \cdot m^2}{s}$ B) $\frac{kg \cdot m^2}{s^2}$
C) $\frac{kg \cdot m}{s}$ D) $\frac{kg \cdot m}{s^2}$

41. An operating 100.-watt lamp is connected to a 120-volt outlet. What is the total electrical energy used by the lamp in 60. seconds?

A) 1.7 J B) 6.0×10^3 J
C) 0.60 J D) 7.2×10^3 J

42. A spring with a spring constant of 4.0 newtons per meter is compressed by a force of 1.2 newtons. What is the total elastic potential energy stored in this compressed spring?

A) 0.36 J B) 0.18 J
C) 4.8 J D) 0.60 J

43. The gravitational potential energy, with respect to Earth, that is possessed by an object is dependent on the object's

A) acceleration B) position
C) momentum D) speed

44. **This question has only three choices.**

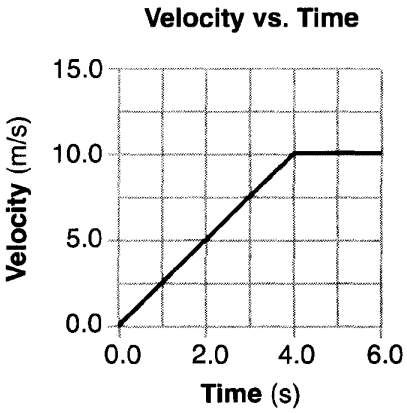
As a ball falls freely toward the ground, its total mechanical energy

A) decreases B) increases
C) remains the same

45. A 70.-kilogram cyclist develops 210 watts of power while pedaling at a constant velocity of 7.0 meters per second east. What average force is exerted eastward on the bicycle to maintain this constant speed?

A) 490 N B) 30. N
C) 3.0 N D) 0 N

Base your answers to questions **46** and **47** on the graph below, which represents the motion of a car during a 6.0-second time interval.



46. What is the acceleration of the car at t = 5.0 seconds ?

A) 0.0 m/s^2 B) 2.0 m/s^2
C) 2.5 m/s^2 D) 10. m/s^2

47. What is the total distance traveled by the car during this 6.0-second interval?

A) 60. m B) 20. m
C) 40. m D) 10. m

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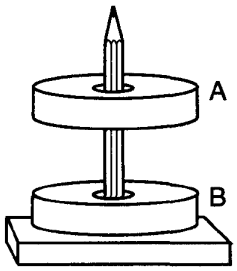
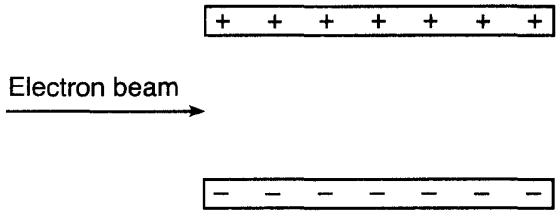
48. When two ring magnets are placed on a pencil, magnet *A* remains suspended above magnet *B*, as shown below.



Which statement describes the gravitational force and the magnetic force acting on magnet *A* due to magnet *B*?

A) The gravitational force is attractive and the magnetic force is repulsive.
B) The gravitational force is repulsive and the magnetic force is attractive.
C) Both the gravitational force and the magnetic force are attractive.
D) Both the gravitational force and the magnetic force are repulsive.

49. A beam of electrons is directed into the electric field between two oppositely charged parallel plates, as shown in the diagram below.



The electrostatic force exerted on the electrons by the electric field is directed

A) toward the top of the page
B) out of the page
C) into the page
D) toward the bottom of the page

50. A motorcycle being driven on a dirt path hits a rock. Its 60.-kilogram cyclist is projected over the handlebars at 20. meters per second into a haystack. If the cyclist is brought to rest in 0.50 second, the magnitude of the average force exerted on the cyclist by the haystack is

A) 2.4×10^3 N B) 6.0×10^1 N
C) 5.9×10^2 N D) 1.2×10^3 N

51. In a simple electric circuit, a 24-ohm resistor is connected across a 6.0-volt battery. What is the current in the circuit?

A) 4.0 A B) 1.0 A
C) 140 A D) 0.25 A

52. A person weighing 785 newtons on the surface of Earth would weigh 298 newtons on the surface of Mars. What is the magnitude of the gravitational field strength on the surface of Mars?

A) 3.72 N/kg B) 9.81 N/kg
C) 6.09 N/kg D) 2.63 N/kg

53. Which quantity is a vector?

A) power B) speed
C) impulse D) time

54. A 0.50-kilogram cart is rolling at a speed of 0.40 meter per second. If the speed of the cart is doubled, the inertia of the cart is

A) quadrupled B) halved
C) unchanged D) doubled

55. A golf ball is given an initial speed of 20. meters per second and returns to level ground. Which launch angle above level ground results in the ball traveling the greatest horizontal distance? [Neglect friction.]

A) 60° B) 45° C) 15° D) 30.°

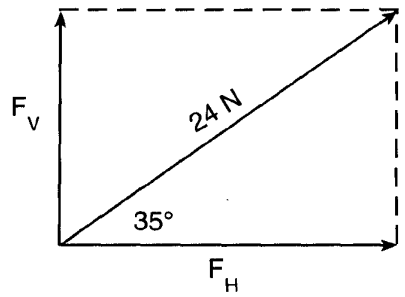
56. A high-speed train in Japan travels a distance of 300. kilometers in 3.60×10^3 seconds. What is the average speed of this train?

A) 1.20×10^{-2} m/s B) 12.0 m/s
C) 8.33×10^{-2} m/s D) 83.3 m/s

57. A 3.0-ohm resistor arid a 6.0-ohm resistor are connected in series in an operating electric circuit. If the current through the 3.0-ohm resistor is 4.0 amperes, what is the potential difference across the 6.0-ohm resistor?

A) 8.0 V B) 2.0 V C) 12 V D) 24 V

58. The vector diagram below represents the horizontal component, F_H, and the vertical component, F_V, of a 24-newton force acting at 35° above the horizontal.



What are the magnitudes of the horizontal and vertical components?

A) $F_H = 20.$ N and $F_V = 14$ N
B) $F_H = 3.5$ N and $F_V = 4.9$ N
C) $F_H = 14$ N and $F_V = 20.$ N
D) $F_H = 4.9$ N and $F_V = 3.5$ N

59. The work done in lifting an apple one meter near Earth's surface is approximately

A) 1 J B) 0.01 J
C) 100 J D) 1000 J

60. Which body is in equilibrium?

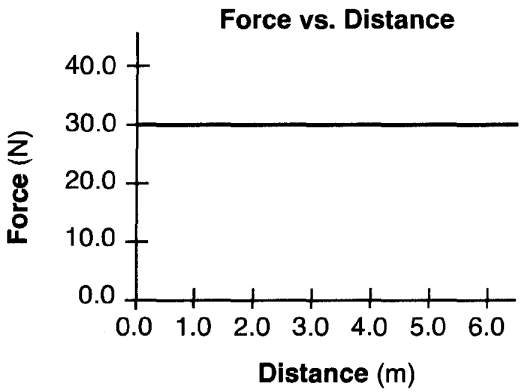
A) a car moving with a constant speed along a straight, level road
B) a projectile at the highest point in its trajectory
C) a satellite orbiting Earth in a circular orbit
D) a ball falling freely toward the surface of Earth

61. What is the weight of a 2.00-kilogram object on the surface of Earth?

A) 4.91 N B) 2.00 N
C) 9.81 N D) 19.6 N

Base your answers to questions **62** and **63** on the information below.

A boy pushes his wagon at constant speed along a level sidewalk. The graph below represents the relationship between the horizontal force exerted by the boy and the distance the wagon moves.



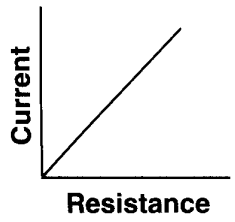
62. What is the total work done by the boy in pushing the wagon 4.0 meters?

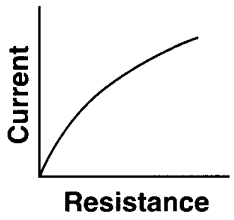
A) 7.5 J B) 120 J C) 180 J D) 5.0 J

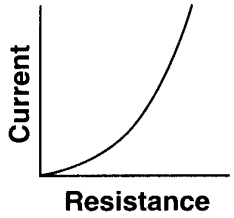
63. As the boy pushes the wagon, what happens to the wagon's energy?

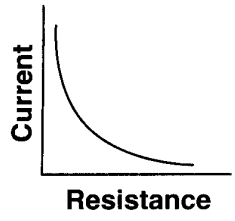
A) Internal energy decreases.
B) Internal energy increases.
C) Gravitational potential energy decreases.
D) Gravitational potential energy increases.

64. A constant potential difference is applied across a variable resistor held at constant temperature. Which graph best represents the relationship between the resistance of the variable resistor and the current through it?

A)


B)


C)


D)


65. On a highway, a car is driven 80. kilometers during the first 1.00 hour of travel, 50. kilometers during the next 0.50 hour, and 40. kilometers in the final 0.50 hour. What is the car's average speed for the entire trip?

A) 60. km/h B) 170 km/h
C) 45 km/h D) 85 km/h

66. A distance of 1.0 meter separates the centers of two small charged spheres. The spheres exert gravitational force F_g and electrostatic force F_e on each other. If the distance between the spheres' centers is increased to 3.0 meters, the gravitational force and electrostatic force, respectively, may be represented as

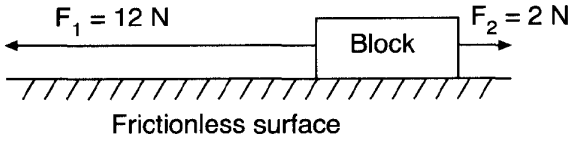
A) $9F_g$ and $9F_e$ B) $\frac{F_g}{3}$ and $\frac{F_e}{3}$

C) $\frac{F_g}{9}$ and $\frac{F_e}{9}$ D) $3F_g$ and $3F_e$

67. The electrical resistance of a metallic conductor is inversely proportional to its

A) length
B) resistivity
C) cross-sectional area
D) temperature

68. Two forces, F_1 and F_2, are applied to a block on a frictionless, horizontal surface as shown below.



If the magnitude of the block's acceleration is 2.0 meters per second^2, what is the mass of the block?

A) 1 kg B) 5 kg C) 6 kg D) 7 kg